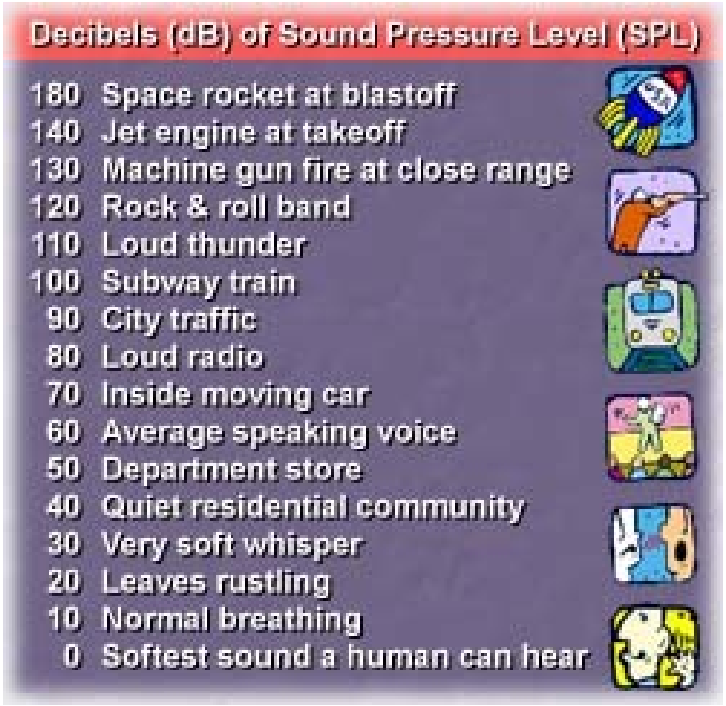
NOISE MEASUREMENT & CONTROL

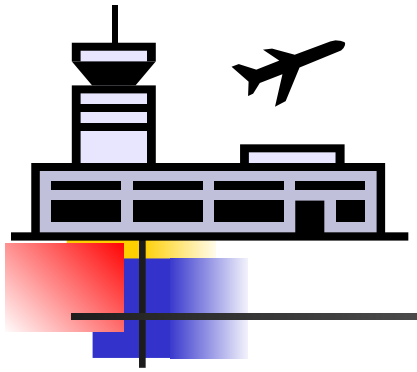

Decibels (dB) of Sound Pressure Level (SPL)
180 Space rocket at blastoff
140 Jet engine at takeoff
130 Machine gun fire at close range
120 Rock & roll band
110 Loud thunder
100 Subway train
90 City traffic
80 Loud radio
70 Inside moving car
60 Average speaking voice
50 Department store
40 Quiet residential community
30 Very soft whisper
20 Leaves rustling
10 Normal breathing
0 Softest sound a human can hear

Purpose of Noise Hazard Evaluation

- **Measure & Identify noise hazardous equipment, operations & locations for the purpose of protecting exposed personnel.**
  - **Hazardous noise is defined as:**

    > 84 dBA for steady-state noise

    ≥140 dBP impulse/impact noise
- **Determine if noise hazards can be eliminated or reduced through Engineering Controls**
  - **Engineering controls should be the primary means of protection.**
  - **All practical approaches to engineer noise out of the workplace should be explored.**
  - **Engineering controls may not affect combat readiness/equipment.**
  - **New equipment should have the lowest noise levels possible.**



Purpose of Noise Hazard Evaluation(cont.)

To determine if noise hazards can be eliminated or reduced through Engineering Controls:

- **EC <u>should</u> be the primary means of protecting personnel from hazardous noise**
- **Explore all practical engineering approaches to reduce noise levels to below hazard criteria**
- **EC feasibility study mandated where workers exposed to >100dBA for ≥4 consecutive hours**
- **EC are applied to military unique workplaces within constraints of maintaining combat readiness**
- **New equipment being considered for purchase should have the lowest technologically & economically feasible noise emission levels**

Purpose of Noise Hazard Evaluation

Identify and label noise hazardous areas and equipment

- **Signs & labels inform workers when it is necessary to wear HPD's.**
- **Signs are placed on doors only if entire space is noise hazardous**
- **Exception: no labels on combat equipment and tactical vehicles.**

Purpose of Noise Hazard Evaluation(cont.)

- **Enroll personnel at risk in the HCP**
  - **Noise hazard data is vital for determining who is exposed and enrolling them in the HCP. Enrollment is based on >84 dBA TWA, not short term exposure.**
  - **Absence of noise data does not prevent HCP enrollment.**
  - **Where specific data unavailable, may enroll based on Similar Exposure Groups (SEGs).**
  - **HPDs required whenever sound exceeds 84dBA or 140dB Peak, although HCP enrollment may not be requ**

Noise Hazard Evaluations

- **Baseline surveys are conducted at least once on all noise hazardous areas/operations , and re-surveyed within 30 days of a change in noise conditions/operations.**
- **Performed by:**
  - **Industrial Hygienists - (Primary responsibility)**
  - **Audiologists**
  - **Trained tech nder IH supervision**

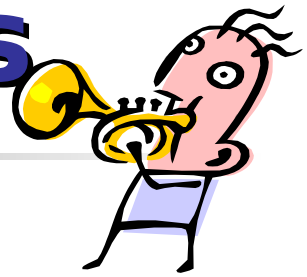
Equipment Used

- **Sound Level Meter (SLM) – Screen for noise hazards (environmental sample) and perform octave band analysis to identify noise sources with a potential for engineering controls**
- **If the screening detects noise levels above 84 dBA, then a dosimeter is used to determine the individual time weighted average (TWA) projected over an 8-hour work day**
- **Type 1 or 2 SLM can be used.**

Types of Sound Level Meters

- **Type 1 – Precision Sound Level Meter**
  - **Very expensive**
  - **Allowable variance is +/- 1 dB accuracy**
  - **With peripheral equipment, can do octave band analysis, audiometer cal. & booth certification**
- **Type 2 – General Purpose**
  - **Allowable variance is +/- 2 dB accuracy**
  - **For screening and environmental samples**
  - **Impulse noise measurements require a special meter with peak holding capability**

Weighting Networks in Sound Level Meters



"A" Weighting Network

- Response curve is similar to sensitivity of human ear
- Biased against low frequencies
- Used to estimate risk of hearing loss in humans

"C" Weighting Network

- Filters out very little (only some very low frequencies)
- Noise has a significant low frequency component if C-weighted measurements are substantially higher than A-weighted values
- C-scale also used to estimate HPD effectiveness

Operation of a Sound Level Meter

Typical Control Switches

- **On /off switch**
- **Battery check switch**
- **Weighting Network selector**
- **Fast / slow meter response selector**
- **Attenuator – dB range selector**
- **Display meter**

Operating Instructions (Nutshell Version)

- Check calibration – demonstrate use of calibrator
- Set weighting switch to dBA
- Set meter response to slow
- Adjust meter range switch, working from 130dB down until meter deflection seen (avoids pegging meter for non-LEDs)
- Hold the SLM at ear level, close to the worker's most exposed ear
- Read dB level on display mete
- Record results on proper form
- Re-check calibration

Factors Affecting Validity of Sound Level Readings

- Weak battery
- Body baffle effect – microphone held too close to your body may cause absorption or reflection of sound
- Shielding effect – occurs when measurer's body or other object is located between the sound source and the mike
- Wind noise – wind velocities above 5 mph may affect measurements; microphone windscreen helpful
- Humidity / moisture on microphone or inside meter
- Microphone size –
  - The half-inch mike is for general use
  - larger mike (1") is better for measuring soft sounds, as with audio booth certification
- Operator errors

Inverse Square Law (And other Truisms)

Intensity = one divided by distance squared

- **Doubling the distance from a sound source (in air) reduces noise level by 6 dB (applies in far field only, at several yards distance)**
- **This principle is used to define the noise hazard radius**
- **Very useful for some noise control applications (example firing ranges)**

Combining 2 noise sources:

- Combining 2 noise sources of equal intensity adds 3 dB (80dB + 80dB = 83dB)
- The greater the difference in intensity, the less the lower value has an effect
  - Example: 80dB + 75dB = 81.2dB

Care of the Sound Level Meter

- SLM and calibrator must be sent for electro-acoustic calibration annually
- Before any measurements are made, check and adjust calibration – then re-check after measurements are taken
- Avoid jarring/bumping
- Do not touch microphone
- Store in a dry, safe place with battery removed

Dosimeter / TWA

- **Dosimeter – measures the Time Weighted Average (TWA), or avg dB exposure projected over an 8 hour day, using the A scale**
- **TWA's should be measured for all DOD civilian employees routinely exposed to hazardous noise**
- **TWA's are also required for military personnel working in industrial-type operations**
- **Record once, and repeat ≤30 days after change affecting noise levels**
- **Document TWA's in the health record**
- **SEG's may be used**

Dosimeter / TWA Strategies for acquiring TWA's

- Personal dosimetry is the only reliable method for determining noise dose.
- Results from previous measurements can be applied to Similar Exposure Groups (SEGs) when all personnel cannot be individually surveyed
- Area monitoring (not recommended)
- Use calculation based on consecutive SLM measurement data (not recomme

Dosimetry

- Factors that affect validity of dosimetry:
  - Microphone placement & stability
  - Employee tampering with dosimeter
  - Is the work environment being measured typical of the employee's regular work day exposures?

QUESTIONS???